

same processes as conventional composites. The composite structure's mechanical properties at temperatures below  $T_g$  are unaffected by repeated stowage-deployment cycles.

*This work was done by Robert M. Schueler of Cornerstone Research Group, Inc. for Glenn Research Center.*

*Inquiries concerning rights for the commercial use of this invention should be addressed*

*to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17982-1.*

## Fuel-Cell Electrolytes Based on Organosilica Hybrid Proton Conductors

*NASA's Jet Propulsion Laboratory, Pasadena, California*

A new membrane composite material that combines an organosilica proton conductor with perfluorinated Nafion material to achieve good proton conductivity and high-temperature performance for membranes used for fuel cells in stationary, transportation, and portable applications has been developed.

To achieve high proton conductivities of the order of  $10^{-1} \text{ S cm}^{-1}$  over a wide range of temperatures, a composite membrane based on a new class of mesoporous, proton-conducting, hydrogen-

bonded organosilica, used with Nafion, will allow for water retention and high proton conductivity over a wider range of temperatures than currently offered by Nafion alone. At the time of this reporting, this innovation is at the concept level. Some of the materials and processes investigated have shown good proton conductivity, but membranes have not yet been prepared and demonstrated.

*This work was done by Sri R. Narayan and Shiao-Pin S. Yen of Caltech for NASA's Jet Propulsion Laboratory.*

*In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:*

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*Refer to NPO-40228, volume and number of this NASA Tech Briefs issue, and the page number.*

## Molecules for Fluorescence Detection of Specific Chemicals

**These molecules could be used in the detection of chemical warfare agents.**

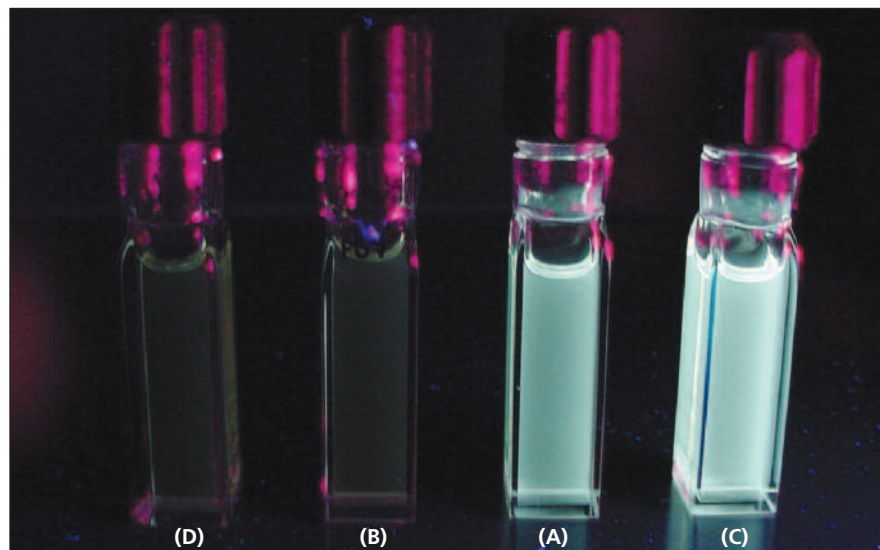
*John H. Glenn Research Center, Cleveland, Ohio*

A family of fluorescent dye molecules has been developed for use in "on-off" fluorescence detection of specific chemicals. By themselves, these molecules do not fluoresce. However, when exposed to certain chemical analytes in liquid or vapor forms, they do fluoresce (see figure). These compounds are amenable to fixation on or in a variety of substrates for use in fluorescence-based detection devices: they can be chemically modified to anchor them to porous or non-porous solid supports or can be incorporated into polymer films. Potential applications for these compounds include detection of chemical warfare agents, sensing of acidity or alkalinity, and fluorescent tagging of proteins in pharmaceutical research and development. These molecules could also be exploited for use as two-photon materials for photodynamic therapy in the treatment of certain cancers and other diseases.

A molecule in this family consists of a fluorescent core (such as an anthracene or pyrene) attached to two

end groups that, when the dye is excited by absorption of light, transfer an electron to the core, thereby quenching the fluorescence. The end groups

can be engineered so that they react chemically with certain analytes. Upon reaction, electrons on the end groups are no longer available for transfer to



**The Effects of Adding Different Analytes** are illustrated on the activation of a fluorescent "on-off" sensor. Shown are sensor molecules before activation (D), after activation by treatment with acid (A), acid treated sample that has been deactivated by treatment with base (B), and sensor molecule activated by treatment with acetyl chloride (C).

the core and, consequently, the fluorescence from the core is no longer quenched.

The chemoselectivity of these molecules can be changed by changing the end groups. For example, aniline end groups afford a capability for sensing acids or acid halides (including those contained in chemical warfare agents). Pyridine or bipyridyl end groups would enable sensing of metal ions. Other

chemicals that can be selectively detected through suitable choice of end groups include glucose and proteins. Moreover, the fluorescent cores can be changed to alter light-absorption and -emission characteristics: anthracene cores fluoresce at wavelengths around 500 nm, whereas perylene cores absorb and emit at wavelengths of about 600 nm.

*This work was done by Michael A. Meador of Glenn Research Center and Daniel S.*

*Tyson and Ulvi F. Ilhan of Ohio Aerospace Institute. Further information is contained in a TSP (see page 1).*

*Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18059-1.*